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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/920,891	08/02/2001	Michael Kwan	A4231/T34410	9729

7590

03/11/2002

Patent Counsel  
Applied Materials, Inc.  
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EXAMINER

KACKAR, RAM N

ART UNIT

PAPER NUMBER

1763

DATE MAILED: 03/11/2002

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Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/920,891

Applicant(s)

KWAN ET AL.

Examiner

Ram N Kackar

Art Unit

1763

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 02 August 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 17-22 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 17-22 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 1,3.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

### DETAILED ACTION

1. This application filed under former 37 CFR 1.60 lacks the necessary reference to the prior application. A statement reading "This is a division of Application No. 09/648395, filed 08/24/2000 should be entered following the title of the invention or as the first sentence of the specification. Also, the current status of all non provisional parent applications referenced should be included.

#### *Claim Rejections - 35 USC § 103*

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 17-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hong et al (US patent Number 5990000) in view of Papasouliotis et al (US patent Number 6030881).

Regarding claims 17 and 20: Hong et al have disclosed a computer readable storage medium having a computer readable program embodied therein (See Col 6 line 58-65), for controlling the mixture of gases, chamber pressure and temperature, RF power levels for plasma generation, pedestal position and other parameters of a process for deposition of a dielectric layer according to a flow chart where Hong et al have disclosed a three-step deposition/etch back/deposition process (See Fig 2A 230-245). Hong et al have also disclosed that a simultaneous deposition and etch would slow the deposition on top of the

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side walls, there by allowing the bottom of the gap to fill before the top closes. (Col 1 line 65 to Col 2 line 3).

Regarding claim 17a,b,e, f and 20(a-g(i and ii)): Hong et al have not disclosed that the deposition part of their three-step process could be either a simultaneous deposition/sputter or deposition/Etch process. Consequently they did not disclose either a mixture of deposition and inert gas or the ratio of deposition and sputter. Papasouliotis et al have disclosed a multi step process using a mixture of deposition and an inert gas and taught that the ratio of deposition/etch for first step, being a simultaneous deposition and etch, should be greater than 1 so as to ensure net deposition. Papasouliotis et al have also taught that the third step in their multi step process would be another deposition/sputter step with a ratio of deposition/etch  $>1$  (See the abstract). Further Papasouliotis et al have recommended the ratio of dep/etch to be between 4 and 50 (Col 4 line 10-16). Therefore it would have been obvious to one having ordinary skill in the art at the time invention was made to modify the simple deposition steps (Step 230 and 245 of Fig 2A) of Hong et al's to simultaneous deposition/sputter steps by using a mixture of deposition and inert gas and maintain the ratio of Deposition/Sputter greater than 1 in order to have net deposition over gaps of high aspect ratios and be able to fill the bottom of the gap better before the closure of the gap at the top.

Regarding Claim 17 (c,d) and 20(g(iii-iv)) Hong et al have disclosed a chemical etch step (Step 235 Fig 2A) after the first deposition step. Hong et al have not explicitly disclosed a

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substrate cooling step before starting etchant gases. As the deposition step was typically done at a higher substrate temperature (See Col 4 line 24, Step 210 Fig 2A and US Patent 5937323 Col 1 line 30-34) and the dependence of chemical etch upon temperature (US patent 6015760 Col 2 line 36-44.) was well known in the art, it would have been obvious to one having ordinary skill in the art at the time invention was made to bring substrate to a lower temperature after deposition step was done so as to be able to control the substrate temperature adequately during chemical etch.

Regarding Claim 18 and 21: Hong et al have not disclosed that the second deposition part of their three-step process could be a simultaneous deposition/sputter. Consequently they did not address the ratio of deposition and sputter. Papasouliotis et al have disclosed a multi step process and taught that the ratio of deposition/etch should be greater than 1 for step third which would be second deposition step. Further Papasouliotis et al have recommended the ratio of dep/etch to be between 4 and 50. Therefore it would have been obvious to one having ordinary skill in the art at the time invention was made to modify the simple deposition steps (Step 245 of Fig 2A) of Hong et al's to simultaneous deposition/sputter steps and maintain the ratio of Deposition/Sputter greater than 1 in order to fill gaps of high aspect ratios to a greater height before the opening of the gap closed.

Regarding Claim 19 and 22: Hong et al have disclosed a computer readable storage medium having a computer readable program embodied there in (See Col 6 line 58-65), for deposition of a first layer of dielectric film over substrate so that it covers plurality of raised features and at least partially fills in gaps. (See Col 15 line 30-33).

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*Conclusion*

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- |   |           |         |
|---|-----------|---------|
| 1 | US Patent | 5624582 |
| 2 | US Patent | 5468342 |
| 3 | US Patent | 5915190 |
| 4 | US Patent | 5858876 |
| 5 | US Patent | 5937323 |
| 6 | US Patent | 5968610 |

Article      Temperature dependence of silicon nitride etching by atomic fluorine. By  
Lee M Loewenstein.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ram N Kackar whose telephone number is 703 305 3996. The examiner can normally be reached on M-F 8:00 A.M to 5:P.M.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory Mills can be reached on 703 308 1633. The fax phone numbers for the organization where this application or proceeding is assigned are 703 872 9310 for regular communications and 703 872 9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308 0661.

  
GREGORY MILLS  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 1700